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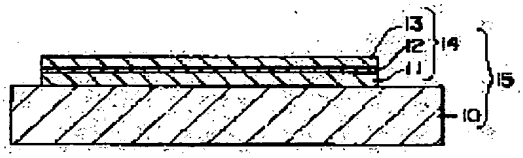
(54) ELECTRODE SUBSTRATE FOR DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an electrode substrate for a display device of a transmission type or reflection type with which stable film formation is made possible with substantially no influence of the gaseous atmosphere at the time of film formation by sputtering and which has high electrical conductivity and visible ray transmittance or reflectivity with thin films, is free from the deterioration with lapse of time and has excellent preservable stability.



SOLUTION: This electrode substrate 15 has conductive films 14 of the constitution which has a conductive thin-film layer 12 of a silver system on a substrate 10 and is formed by holding the front and rear surfaces of this conductive thin-film layer 12 of the silver system by transparent conductive thin-film layers 11, 13 of an oxide system. In such a case, at least either of the transparent conductive thin-film layers 11, 13 of the oxide system are formed as thin-film layers composed of transparent multi component oxide composed of cerium oxide and indium oxide as materials. The conductive thin-film layer 12 of the silver system is formed as the thin-film layer consisting of a silver allay contg. 0.1 to 2.5at.% (atomic weight %) gold and 0.3 to 3.0at.% copper.

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[Claim(s)]
[Claim 1] In the electrode substrate for displays equipped with the electric conduction film of a configuration of having pinched the front rear face of this silver system electric conduction thin film layer for the silver system electric conduction thin film layer in the oxide system transparence electric conduction thin film layer in preparation for a substrate top At least one side of the above-mentioned oxide system transparence electric conduction thin film layer is a thin film layer by the transparent mixed oxide made from cerium oxide and indium oxide. Said silver system electric conduction thin film layer 0.1 - 2.5at% gold, The electrode substrate for displays characterized by being a thin film layer by the silver alloy containing 0.3 - 3.0at% copper.
[Claim 2] The electrode substrate for displays according to claim 1 in within the limits whose thickness of said silver system electric conduction thin film layer is 5-25nm.
[Claim 3] The electrode substrate for displays according to claim 1 in within the limits whose thickness of said silver system electric conduction thin film layer is 50-200nm.
[Claim 4] The electrode substrate for displays according to claim 1 or 2 with which the color filter is arranged between said substrates and electric conduction film.
[Claim 5] The electrode substrate for displays according to claim 1, 2, or 4 with which the light-scattering film is arranged between said substrates and electric conduction film.
[Claim 6] The electrode substrate for displays according to claim 1 or 3 which is the reflexibility thin film layer of a high refractive index with said larger oxide system transparence electric conduction thin film layer located between said substrate and a silver system electric conduction thin film layer than a refractive index 2.1.
[Claim 7] The electrode substrate for displays according to claim 1 or 3 equipped with the reflexibility oxide system thin film layer which serves as a larger high refractive-index insulator layer than a refractive index 2.1 between said substrates and electric conduction film.

[Detailed Description of the Invention]

[0001]
[Field of the Invention] About the electrode substrate of a transparency mold electrode (transparent electrode) or a reflective mold electrode used for a display for I/O or a solar battery etc. which carries out a direct input from an output display unit or the display screens, such as liquid crystal display equipment and plasma display equipment, conductivity and light transmission of this invention are high at especially a thin film, and it relates to the electrode substrate which was moreover excellent in preservation stability.
[0002]
[Description of the Prior Art] The electrode plate with which the transparence electric conduction film of the electrode configuration which penetrates a visible ray was prepared on substrates, such as glass and plastic film, is widely used for the electrode for a display of various displays (display screen), such as liquid crystal display equipment, the I/O electrode which can carry out a direct input from the display screen of this display.
[0003] For example, the transparent electrode plate of the display unit with which liquid crystal was used The color filter layer 41 which is prepared in the pixel part on a glass substrate 40 and this glass substrate 40, and colors that transmitted light red, green, and blue for every pixel, respectively as shown in drawing 11 , The light-shielding film 42 which is prepared in the part between the pixels on the above-mentioned glass substrate 40 (between pixels), and prevents the light transmission from this part, The transparent protection layer 43 prepared the whole surface on the above-mentioned color filter layer 41, Membranes are formed by sputtering on this protective layer 43, and that principal part consists of shape of a pattern etched into the predetermined electrode pattern, a solid transparent electrode 44, and orientation film 45 formed on this transparent electrode 44.
[0004] The ITO thin film which added tin oxide in indium oxide as this transparent electrode 44 paying attention to that high conductivity is used widely, that specific resistance is 2.4x10-4 ohm-cm about, and, in the case of the 240nm thickness usually applied as a transparent electrode, that sheet resistivity value is about 10ohms (or 10ohm/**, **; it is called a square).
[0005] Moreover, although the tin oxide thin film, the thin film (Nesa membrane) constituted by tin oxide by adding antimony oxide or the thin film constituted by the zinc oxide by adding an aluminum oxide, etc. is known in addition to this, each of these is inferior to the above-mentioned ITO thin film in conductivity, and since chemical

resistance or a water resisting property to an acid or alkali etc. is inadequate, generally they has not spread as a transparent electrode substrate for liquid crystal.

[0006] On the other hand, in the transparent electrode substrate for solar batteries, it is the relation of the manufacture process and hydrogen plasma resistance is needed. Therefore, it is common to use a transparent electrode made from a zinc oxide with high hydrogen plasma resistance.

[0007] However, what carried out the fluorine dope, and the thing which carried out alumina addition also had high resistance, and the transparent electrode of a zinc-oxide system needed to form it in 400nm - 800nm and quite thick thickness as a transparent electrode substrate for solar batteries.

[0008] On the other hand, in the 7thICVM held in Japan, the transparence electric conduction film of the three-tiered structure which the front rear face of a silver thin film is made to carry out the laminating of an ITO thin film or the indium oxide thin film (IO thin film) as heat ray reflective film, and is constituted is proposed in 1982.

[0009] The transparence electric conduction film of this three-tiered structure has the low sheet resistivity value of about 5ohms, and the application to the above-mentioned transparent electrode was expected taking advantage of that high conductivity.

[0010]

[Problem(s) to be Solved by the Invention] By the way, in the above-mentioned display unit or the I/O device, it is required that increasing a pixel consistency and displaying a precise screen in recent years should be called for, and the eburnation of the above-mentioned transparent electrode pattern should be demanded - in connection with this, for example, the terminal area of the above-mentioned transparent electrode should be constituted from a pitch which is about 100 micrometers.

[0011] Moreover, in the method (COG) with which direct continuation of the IC for a liquid crystal drive is carried out to a substrate in liquid crystal display equipment, there is a part from which leading about of wiring serves as a thin line called width of face of 20-50 micrometers, and the advanced etching processing suitability which is not in the former, and high conductivity (low resistance) are demanded.

[0012] Moreover, on the other hand, enlargement of the display screen was also called for, and in order to form the transparent electrode of a precise pattern which was mentioned above and to enable it to impress sufficient driver voltage for liquid crystal moreover about such large-sized screen-ization, the transparent electrode equipped with the high conductivity of the sheet resistivity value of 5ohms or less as the above-mentioned transparent electrode needed to be applied.

[0013] moreover -- in addition, in the liquid crystal display of the passive-matrix drive method using STN LCD etc., when performing the multi-gradation display of 16 or more gradation, the low sheet resistivity value is demanded of the pan of 3ohms or less.

[0014] However, it also sets to the transparent electrode of the above-mentioned three-tiered structure proposed in the 7thICVM. By the sheet resistivity value of at most about 5ohms not passing being obtained, but there being a trouble that sufficient conductivity is not securable, for example, thickening thickness of a silver thin film at about 16-18nm Even if it is possible to reduce the sheet resistivity value to about 3 ohms, visible-ray permeability (especially a long wave with a wavelength of about 610nm visible-ray permeability by the side of merit) will fall to about 75%, and the function as a transparent electrode will be spoiled.

[0015] furthermore, the moisture in the air into which the silver thin film advanced from the laminating interface etc. in the transparent electrode of the above-mentioned three-tiered structure -- reacting -- easy -- the front face -- a reactant -- generating -- silverfish -- when the defect of a ** was produced, for example, it applied to the transparent electrode of a liquid crystal display, the trouble of being easy to produce a display defect etc. was shown in the front face.

[0016] this invention persons by considering as the silver system electric conduction thin film by the silver alloy which added gold at silver to the damp-proof improvement in the electric conduction film of a three-tiered structure Found out that there was effectiveness of large damp-proof improvement, and this configuration is already proposed. a golden addition -- 4at(s)% (atomic-weight percent is called at% below atomic weight%) -- it has found out that there is effectiveness sufficient by the following, for example, the range of 0.1 - 3.0at%. In addition, the electric conduction film of a three-tiered structure can be used as a reflector which sets thickness to about 150nm practically, and reflects the light as a transparent electrode which penetrates the light for the thickness of a silver system electric conduction thin film layer within the limits of 5nm - 25nm.

[0017] However, the electric conduction film of a three-tiered structure using the silver system electric conduction thin film of a silver gold alloy had the fault which is easy to be influenced of the gas ambient atmosphere at the time of membrane formation of sputtering. There was a fault to

which the effect of the oxygen in an ambient atmosphere is received, the permeability by the side of the short wavelength of a visible region tends to fall to as a transparent electrode, and the reflection factor by the side of short wavelength tends [especially] to fall as a reflector.

[0018] Drawing 7 shows the spectral characteristic (spectral transmittance) of the electric conduction film (transparent electrode) of a configuration of pinching the silver system electric conduction thin film of about 15nm of thickness with a metallic oxide. In addition, the sum total thickness of this electric conduction film is 900A, and a sheet resistivity value is about 3ohms. In addition, ** is shown and, in **, ** shows [graph **] golden 0.4at% silver 99.6at% golden 0.2at% silver 99.8at% golden 0.1at% silver 99.9at% golden 0at% silver 100at%.

[0019] The thing of the electric conduction film by the silver thin film with which the spectral characteristic shown with the broken line of the top of drawing 7 does not contain gold, and others are the spectral characteristics of the electric conduction film of the silver system thin film containing 0.1 - 0.5at% gold, and it is shown that the down of the permeability near 470nm of light wave length arises.

[0020] the same -- drawing 8 -- gold -- 0.8 - 2.5at% -- the spectral characteristic of the electric conduction film of the included three-tiered structure was shown. The permeability of nearly 470nm is similarly downed by this. In addition, the sum total thickness of this electric conduction film is 900A, and a sheet resistivity value is about 3ohms. Moreover, ** is shown and, in graph **, ** shows golden 2.44at% silver 97.56at% golden 1.52at% silver 98.48at% golden 0.81at% silver 99.19at%.

[0021] The down of the transmission by the side of this short wavelength can lessen the amount of that down by lessening effect of oxygen by performing sufficient exhaust air before membrane formation of the silver system thin film by the membrane formation equipment of a batch type.

[0022] However, with the mass-production type membrane formation equipment of an inline type, in case the metallic oxide of the 3rd layer in the electric conduction film of a three-tiered structure is formed with the 1st layer, in order to introduce oxygen, it is easy to be influenced of oxygen.

[0023] In addition, although it seems that the inclination accompanied by the phenomenon in which the refractive index by the side of the short wavelength of a silver system thin film rises is found out, and the light absorption by the side of the short wavelength of the electric conduction film of a three-tiered structure has come out as a result in the range in which this invention persons investigated the optical constant of the electric conduction film of a three-tiered structure, that detail does not yet understand well the down of the permeability by the side of this short wavelength.

[0024] this invention -- being such -- a trouble -- paying one's attention -- making -- having -- the -- a technical problem -- ** -- carrying out -- a place -- sputtering -- membrane formation -- the time -- gas -- an ambient atmosphere -- effect -- winning popularity -- hard -- having been stabilized -- membrane formation -- being possible -- ** -- carrying out -- while -- a thin film -- conductivity -- a visible ray -- permeability -- or -- a reflection factor -- high -- moreover -- passing -- the time -- degradation -- there is nothing -- preservation -- stability -- having excelled -- transparency -- a mold -- or -- reflection -- a mold -- a display -- ** -- an electrode -- a substrate -- providing -- things -- it is .

[0025]

[Means for Solving the Problem] In the electrode substrate for displays equipped with the electric conduction film of a configuration of that invention concerning claim 1 of this invention pinched the front rear face of this silver system electric conduction thin film layer for the silver system electric conduction thin film layer in the oxide system transparence ****** thin film layer in preparation for a substrate top At least one side of the above-mentioned oxide system transparence electric conduction thin film layer is a thin film layer by the transparent mixed oxide made from cerium oxide and indium oxide. Said silver system electric conduction thin film layer 0.1 - 2.5at% gold, It is the electrode substrate for displays characterized by being a thin film layer by the silver alloy containing 0.3 - 3.0at% copper.

[0026] Moreover, invention concerning claim 2 of this invention is an electrode substrate for displays which has the thickness of said silver system electric conduction thin film layer within the limits of 5-25nm in invention indicated to said claim 1.

[0027] Moreover, invention concerning claim 3 of this invention is an electrode substrate for displays in within the limits whose thickness of said silver system electric conduction thin film layer is 50-200nm in invention indicated to said claim 1.

[0028] Moreover, invention concerning claim 4 of this invention is an electrode substrate for displays with which the color filter is arranged between said substrates and electric conduction film in invention indicated to said claim 1 or claim 2.

[0029] Moreover, invention concerning claim 5 of

this invention is an electrode substrate for displays with which the light-scattering film is arranged between said substrates and electric conduction film in invention indicated to said claim 1, claim 2, or claim 4.

[0030] Moreover, invention concerning claim 6 of this invention is an electrode substrate for displays which is the reflexibility thin film layer of a high refractive index with said larger oxide system transparence electric conduction thin film layer located between said substrate and a silver system electric conduction thin film layer than a refractive index 2.1 in invention indicated to said claim 1 or claim 3.

[0031] Moreover, invention concerning claim 7 of this invention is an electrode substrate for displays equipped with the reflexibility oxide system thin film layer which serves as the larger insulator layer of a high refractive index than a refractive index 2.1 between said substrates and electric conduction film in invention indicated to said claim 1 or claim 3.

[0032]

[Embodiment of the Invention] Invention concerning claim 1 of this invention is explained below at a detail according to the gestalt of operation.

[0033] In the electrode substrate for displays equipped with the electric conduction film of a configuration of that invention concerning claim 1 of this invention pinched the front rear face of this silver system electric conduction thin film layer for the silver system electric conduction thin film layer in the oxide system transparence ****** thin film layer in preparation for a substrate top At least one side of the above-mentioned oxide system transparence electric conduction thin film layer is a thin film layer by the transparent mixed oxide made from cerium oxide and indium oxide. Said silver system electric conduction thin film layer 0.1 - 2.5at% gold, It is the electrode substrate for displays which is a thin film layer by the silver alloy containing 0.3 - 3.0at% copper.

[0034] This invention found out that effect by the ambient atmosphere of sputtering membrane formation could be lessened at the time of silver system thin film membrane formation by forming a silver system thin film into the alloy of silver and gold as above-mentioned The means for solving a technical problem using the silver gilt bronze alloy which added copper further.

[0035] In this case, effect with the down of the permeability by the side of the short wavelength of the electric conduction film of a three-tiered structure using the silver system thin film which the small quantity not more than 3at% is sufficient as an addition, and contains gold by addition of a small amount of copper, or a reflection factor bad [gold, copper, and all] etc. can be lost.

[0036] Furthermore, this invention persons found out that permeability could be improved and moisture resistance could be improved by using the mixed oxide which mixed with indium oxide the cerium oxide which is a high refractive index as a transparence oxide thin film, when the electric conduction film of a three-tiered structure was used as an application of the electrode substrate for displays of a transparency mold (transparent electrode).

[0037] Little addition of the metallic oxide of titanium oxide, a zirconium dioxide, an oxidization hafnium, tantalum oxide, a silicon dioxide, an oxidization gallium, tin oxide, the bisumuth oxide, and others may be carried out at a mixed oxide if needed.

[0038] The addition of the gold to the above-mentioned silver system electric conduction thin film layer on the above-mentioned substrate has the inclination for moisture resistance to improve as it is effective from 0.1at% of little addition and makes [many] this addition about the improvement in moisture resistance respectively of the conductive glue line which is the electric conduction film of a three-tiered structure, a silver system electric conduction thin film layer, and an oxide system transparence electric conduction thin film layer.

[0039] The addition to a copper silver system thin film is effective in raising the depression by the side of short wavelength gradually from about 0.3at%, as shown in the graph of drawing 6 . In addition, this graph is the electric conduction film of a three-tiered structure, and the total thickness of the electric conduction film is about 850A (85nm).

[0040] In order that it may take the form of an eutectic to silver (it is not full dissolution), copper will come to have bad effect on permeability or a reflection factor, if a copper addition increases. Moreover, when the addition increased, there is an inclination for the resistance of the electric conduction film to rise, and thickness of a silver system thin film is set to 10mm and a copper addition is made more than 3at%, a sheet resistivity value comes to exceed 5 ohms (or 5ohm/**, **; it calls square).

[0041] Next, invention concerning claim 2 of this invention is explained below at a detail according to the gestalt of operation.

[0042] Invention concerning claim 2 of this invention is an electrode substrate for displays which has the thickness of said silver system electric conduction thin film layer within the limits of 5-25nm in invention indicated to said claim 1.

[0043] Recently, technical progress of the liquid crystal display equipment in passive matrices, such as STN and ECB, has a motion that it is remarkable and a color STN will be used as a monitor of a CRT alternative.

[0044] In the case of a deferred monitor, connection with external powers, such as 100V and 110V, is possible, and daily use of the back light of high brightness is attained from such a thing.

[0045] From this viewpoint, with the liquid crystal display of the passive matrix of a monitor application, the transparent electrode used for this will give priority to being low resistance, and may make light transmittance a sacrifice to some extent.

[0046] At a passive matrix, if the sheet resistivity value of a transparent electrode becomes near 2ohm, since deterioration of the image quality called shadowing will almost be lost, it can compete with TFT on practical use level.

[0047] The spectral characteristic data based on the simulation of the transparent electric conduction film which carried out the laminating of 35nm (refractive index 2.2) of transparence oxides, and 15nm - 25nm of silver system thin films and 40nm of transparence oxides to drawing 9 one by one on the glass substrate the premise [the application of the electrode substrate for transparency mold displays (transparent electrode)] were shown. In addition, the medium was made into Ayr (gas; refractive index 1.5). in addition, the thickness of a silver system thin film -- in **, 20nm of thickness and ** show 22.5nm of thickness, and, as for 15nm of thickness, and **, ** shows the case of 25nm of thickness, as for 17.5nm of thickness, and **.

[0048] The perméability of a peak has the thickness of a silver system thin film comparatively as good as 80% also in 25nm and a thick field. Moreover, the sheet resistivity value of the electric conduction film of a three-tiered structure is set to about 2 ohms by a little more than 20nm of thickness of a silver system thin film.

[0049] A silver system thin film becomes island-like (the shape of a land) in less than 5nm of thickness, and does not turn into a homogeneous thin film, but the optical property and sheet resistivity value on count become difficult to get.

[0050] Next, invention concerning claim 3 of this invention is explained below at a detail according to the gestalt of operation.

[0051] Invention concerning claim 3 of this invention is an electrode substrate for displays in within the limits whose thickness of said silver system electric conduction thin film layer is 50-200nm in invention indicated to said claim 1.

[0052] The simulation result of the reflection factor of the electric conduction film which carried out the laminating of 10nm of transparence oxides, and 50nm - 200nm of silver system thin films and 40nm (refractive index 2.3) of transparence oxides to drawing 10 one by one on the glass substrate the premise [the application of the electrode substrate for displays of a reflective mold (reflector)] was shown. In addition, the medium was made into Ayr (gas; refractive index 1). Moreover, this simulation is not taking into consideration change (wavelength dispersion) of the refractive index by the light wave length of a transparence oxide, or an optical extinction (light absorption) multiplier.

[0053] Although drawing 10 shows the effect on the reflection factor by the thickness of a silver system thin film, if the thickness of a silver system thin film exceeds 50nm, it will serve as a reflector around 80%, a reflection factor is saturated with 200nm, and it is shown that light transmittance becomes about 0%.

[0054] Next, invention concerning claim 4 of this invention is explained below at a detail according to the gestalt of operation.

[0055] Invention concerning claim 4 of this invention is an electrode substrate for displays with which the color filter is arranged between said substrates and electric conduction film in invention indicated to said claim 1 or claim 2.

[0056] The display of a color picture of the above-mentioned electrode substrate is attained by arranging the color filter colored red, green, blue, etc. corresponding to the display pixel, respectively between the substrate in the electrode substrate for the displays of a transparency mold or a reflective mold (for example, electrode substrate for liquid crystal displays), and the electric conduction film of the three-tiered structure which is a transparent electrode.

[0057] Next, invention concerning claim 5 of this invention is explained below at a detail according to the gestalt of operation.

[0058] Invention concerning claim 5 of this invention is an electrode substrate for displays with which the light-scattering film is arranged between said substrates and electric conduction film in invention indicated to said claim 1, claim 2, or claim 4.

[0059] In order to extend an angle of visibility even if it is a transparency mold when using as an electrode substrate for the displays of a reflective mold (for example, electrode substrate for liquid crystal displays) or, high effectiveness can be acquired by arranging the dispersion film (DEFUYUJON film which gives the spreading effect of light) of light between a substrate and the

electric conduction film.

[0060] Since the above-mentioned dispersion film is piled up on a color filter, a color filter may be the lamination of another object and it may be a configuration which serves both as a color filter and the dispersion film.

[0061] The above-mentioned dispersion film may use dispersion (diffusion) of the light by the irregularity (or irregularity of the spreading film front face where refractive indexes differ) of a spreading film front face, and the spreading film of the resin which mixed the resin with which mixing differs the resin with which refractive indexes differ from a refractive index, and the glazing color can be used for it. Moreover, in the case of the method [liquid crystal display / target] using a polarization film or a phase contrast film, the **** ingredients [targets /, such as an amorphous substance and quality of equiaxed grain, / optical] of said glazing color are desirable.

[0062] Next, invention concerning claim 6 of this invention and claim 7 is explained below at a detail according to the gestalt of operation.

[0063] Invention concerning claim 6 of this invention is an electrode substrate for displays said whose oxide system transparence electric conduction thin film layer located between said substrate and a silver system electric conduction thin film layer is a larger thin film layer (reflexibility oxide system transparence electric conduction thin film layer) of a high refractive index than a refractive index 2.1 in invention indicated to said claim 1 or claim 3.

[0064] Moreover, invention concerning claim 7 of this invention is an electrode substrate for displays equipped with the reflexibility oxide system thin film layer which serves as the larger insulator layer of a high refractive index than a refractive index 2.1 between said substrates and electric conduction film in invention indicated to said claim 1 or claim 3.

[0065] As an electrode substrate for displays of the reflective mold of passive-matrix LCD (liquid crystal display), such as STN and ECB, when using the electric conduction film of the three-tiered structure of this invention, it is necessary to form electrode patterns, such as the shape of a stripe.

[0066] In the case of LCD of the above-mentioned reflective mold, it is the important point to increase the amount of reflected lights at the time of a white display (usually Nor Marie White).

[0067] however -- if a reflector is processed in the shape of a stripe pattern -- between reflector patterns -- base -- the reflected light from this part which a glass side will not expose will decrease.

[0068] this invention persons found out that the gain of the reflected light was increased and it could utilize effectively as illumination light for a display display of the reflected light by making the thin film layer of a high refractive index remain in a substrate side.

[0069] That is, in invention concerning above-mentioned claim 6, it considers as the electrode substrate for displays using the larger thin film layer of a high refractive index than a refractive index 2.1 as said oxide system transparence electric conduction thin film layer located between said substrate and a silver system electric conduction thin film layer.

[0070] It obtains by carrying out pattern etching of the silver system thin film and the oxide system transparence electric conduction thin film layer of another side which are in the upper layer from the oxide system transparence electric conduction thin film layer of one of these of a high refractive index as pattern electric conduction film on said substrate.

[0071] And it is used as this electric conduction film configuration layer in which one [which remains / said] oxide system transparence electric conduction thin film layer of a high refractive index takes charge of one of the electric conduction thin film layers of a three-tiered structure in the part of the pattern electric conduction film, and while using it as an insulator layer in a part without the pattern electric conduction film, it is used as high reflective film for raising a reflection factor.

[0072] Moreover, in invention concerning above-mentioned claim 7, between said substrates and electric conduction film, the oxide system transparence electric conduction thin film layer which serves as the larger insulator layer of a high refractive index than a refractive index 2.1 to a substrate side is formed, and, on the other hand, it considers as the electrode substrate for displays directly.

[0073] And as pattern electric conduction film on said substrate, it is in the upper layer from this oxide system transparence electric conduction thin film layer of a high refractive index directly formed by the substrate side, and obtains by carrying out pattern etching of an oxide system transparence electric conduction thin film layer, a silver system thin film, and the oxide system transparence electric conduction thin film layer of another side.

[0074] And it is used as this electric conduction film configuration layer in which said oxide system transparence electric conduction thin film layer of a high refractive index which remains takes charge of one of the electric conduction thin film layers of 4 layer structure in the part of the pattern electric conduction film, and while using it as an insulator layer in a part without the pattern

electric conduction film, it is used as high reflective film for raising a reflection factor.

[0075] As such an insulator layer of a high refractive index, there are oxides, such as titanium oxide, a zirconium dioxide, an oxidation hafnium, tantalum oxide, and cerium oxide.

[0076] The mixed oxide which carried out little addition of the mixed oxide of such an oxide or other chemical-resistant good oxides, for example, the oxidation gallium etc., can be similarly used as an insulator layer.

[0077] In addition, when using the electrode substrate for displays of this invention as a reflector substrate for LCD of a reflective mold, a substrate may be a substrate which transparence and translucent and opaque any are sufficient as, or was colored black and white and other colors.

[0078] Various things, such as a substrate with which semiconductor devices, such as glass, plastic film, a sheet plastic, a ceramic, a metal plate or an amorphous silicon, polish recon, and MIM, were formed, can be used for the ingredient of a substrate.

[0079] Moreover, since sheet resistivity is low resistance, the electric conduction film of the three-tiered structure in this invention is used for the signal line of components, such as TFT and MIM, a bus line, etc., and can serve as a pixel electrode.

[0080]

[Example] Below, the concrete example of this invention is shown.

[0081] As shown in <example 1> drawing 1 , the electrode substrate 15 concerning this example The oxide system transparence electric conduction thin film layer 11 by the transparence oxide thin film with a thickness of 35nm by which the laminating was carried out one by one on the glass substrate 10 with a thickness of 0.7mm, The transparence electric conduction film 14 with which the principal part consisted of a silver system transparence electric conduction thin film layer 12 by the silver system thin film with a thickness of 14nm and an oxide system transparence electric conduction thin film layer 13 by the transparence oxide thin film with a thickness of 38nm was formed. in addition, metallic element conversion excluding [layers / 11 and 13 / above-mentioned / oxide system transparence electric conduction thin film / the all] oxygen in cerium oxide to the thin film of indium oxide -- 32at(s)% -- it considered as the added mixed oxide. moreover, the silver system transparence electric conduction thin film layer 12 -- silver -- gold -- 1.0at(s)% and copper -- 1.5at(s)% -- it is the silver alloy added, respectively.

[0082] And the above-mentioned transparence electric conduction film 14 is the following, and was made and formed. First, after an organic alkali system surfactant and water washed the front face of the glass substrate 10 with a thickness of 0.7mm, it held in the vacuum tub, plasma treatment called reverse sputtering was performed, and it washed further.

[0083] Next, without taking out this glass substrate 10 out of a vacuum tub, where this glass substrate 10 is maintained to a room temperature, sequential membrane formation of the oxide system transparence electric conduction thin film layer 11 by the transparence mixed oxide thin film with a thickness of 35nm, the silver system transparence electric conduction thin film layer 12 by the silver system thin film with a thickness of 14nm, and the oxide system transparence electric conduction thin film layer 13 by the transparence mixed oxide thin film with a thickness of 38nm was carried out by the sputtering method.

[0084] Next, pattern formation of the resist film of an electrode configuration was carried out on the above-mentioned oxide system transparence electric conduction thin film layer 13, where it carried out pattern etching of the part exposed from this resist film with the nitric-acid system etching reagent and location adjustment of the thin film of the above-mentioned three-tiered structure is carried out mutually, pattern NINGU was carried out at the electrode configuration, then 220 degrees C and annealing treatment (heating aging processing) of 1 hour were performed, and the above-mentioned transparence electric conduction film 14 was formed.

[0085] In this way, the sheet resistivity value of the obtained transparence electric conduction film 14 was about 3.3ohms. And as a continuous line showed the visible-ray permeability of the transparence electric conduction film 14 to drawing 4 , the permeability down by the side of short wavelength was not seen, but the good result was obtained.

[0086] Although surface observation of it was carried out after holding the transparence electric conduction film 14 which carried out [above-mentioned] pattern formation in 60 degrees C and 95% of humidity for 500 hours, appearance change was not produced at all. In addition, it was 2.24 when [which is depended on this mixed oxide] the refractive index of the oxide system transparence electric conduction thin film layers 11 and 13 was measured, respectively.

[0087] In addition, although not illustrated, if the electrode substrate 15 obtained by this example 1 is the electrode substrate 15 for color picture displays, between a substrate 10 and the transparence electric conduction film 14 or on the transparence electric conduction film 14, it will carry out pattern formation of the color filter layer

of the shape of a matrix colored red, green, and blue for every display pixel, and will form the electric conduction film 14 of the shape of a pattern corresponding to the pixel of the shape of the matrix.

[0088] As shown in <example 2> drawing 2 , the electrode substrate 25 concerning this example The oxide system transparence electric conduction thin film layer 21 according to a transparence oxide thin film with a thickness of 35nm one by one to the optical diffusion layer 26 (light-scattering film which extends angle of visibility) top which carried out the laminating on the glass substrate 20 with a thickness of 0.7mm, The transparence electric conduction thin film with which the principal part consisted of a silver system transparence electric conduction thin film layer 22 by the silver system thin film with a thickness of 15nm and an oxide system transparence electric conduction thin film layer 23 by the transparence oxide thin film with a thickness of 38nm was formed, pattern formation was carried out after that, and the transparence electric conduction film 24 was formed. In addition, pattern formation of this transparence electric conduction film 24 was carried out using the same ingredient and same process as the above-mentioned example 1.

[0089] Moreover, the above-mentioned optical diffusion layer 26 is the paint film which made the acrylic epoxy resin carry out distributed mixing of the pulverized coal (powder) of cerium oxide as a light diffusion agent, and was formed in about 1 micrometer of thickness.

[0090] In this way, the sheet resistivity value of the obtained transparence electric conduction film 24 was about 3.3ohms like the example 1. And like the above-mentioned example 1, the permeability down by the side of short wavelength was not seen, but the good result was obtained by the visible-ray permeability of the transparence electric conduction film 24.

[0091] And although surface observation of it was carried out after holding the transparence electric conduction film 24 which carried out [above-mentioned] pattern formation in 60 degrees C and 95% of humidity for 500 hours, appearance change was not produced at all.

[0092] In addition, although not illustrated, if the electrode substrate 25 obtained by this example 2 is the electrode substrate 25 for color picture displays, between a substrate 20 and the transparence electric conduction film 24 or on the transparence electric conduction film 24, it will carry out pattern formation of the color filter layer of the shape of a matrix colored red, green, and blue for every display pixel, and will form the electric conduction film 24 of the shape of a pattern corresponding to the pixel of the shape of the matrix.

[0093] As shown in <example 3> drawing 3 , the electrode substrate 35 concerning this example 30nm or more in thickness by the transparence oxide thin film of the cerium oxide of the high refractive index (2.1 or more refractive indexes) which serves both as an insulator layer and the high reflective film on the glass substrate 30 with a thickness of 0.5mm The oxide system transparence electric conduction thin film layer 31 according to a transparence mixed oxide thin film with a thickness of 10nm one by one after carrying out the laminating of the reflexibility oxide system thin film layer 36 with a thickness of 55nm preferably, The electric conduction thin film 34 (it is not transparent) with which the principal part consisted of a silver system electric conduction thin film layer 32 (it is not transparent) by the silver system thin film with a thickness of 150nm and an oxide system transparence electric conduction thin film layer 33 by the transparence mixed oxide thin film with a thickness of 75nm was formed.

[0094] The oxide system transparence electric conduction thin film layers 31 and 33 formed membranes with the mixed oxide of cerium oxide and indium oxide like the above-mentioned example 1.

[0095] The sheet resistivity value of the electric conduction film of 4 layer structures by the reflexibility oxide system thin film layer 36 of the one above-mentioned layer and the electric conduction thin film 34 of the three above-mentioned layers was about 0.2ohms.

[0096] And as by setting thickness of a silver system thin film to 150nm showed to the graph A of drawing 5 , the reflection factor down by the side of the short wavelength of the electric conduction thin film 34 of three layers became the electrode substrate of good light reflex nature, without being generated.

[0097] by the way, the graph B of this drawing 5 -- silver -- gold -- 1at% -- the data of the spectral reflectance of the electric conduction film (the thickness of a silver system thin film is 150nm) of the conventional three-tiered structure equipped with the silver system thin film layer by the added silver alloy are shown.

[0098] According to this, there are a down of the reflection factor by the side of short wavelength and a down of the spectral reflectance near 460nm, and it is thought that this becomes remarkable by increasing gas installation of the oxygen at the time of membrane formation like the case of the light transmittance in a transparent electrode.

[0099] However, according to this example 3, even if it thickened thickness of a silver system thin

film with 150nm, as shown in the graph A of drawing 5 , the reflection factor down by the side of short wavelength was not generated, but the improvement was found.

[0100] Then, pattern etching of the oxide system transparence electric conduction thin film layers 31 and 33 and the silver system thin film layer 32 was carried out, and the transparence electric conduction film 34 (pattern electric conduction film) was formed. This transparence electric conduction film 34 was performed in the usual FOTORISO process as well as the above-mentioned example 1, and carried out pattern formation using the same ingredient and same process as the above-mentioned example 1. In addition, the reflexibility oxide system thin film layer 36 by the cerium oxide simple substance has acid resistance from others, could leave this by the usual etching and was able to make the part without the pattern electric conduction film carry out residual disclosure of the reflexibility oxide system thin film layer 36.

[0101] And 220 degrees C of substrates 30 which carried out pattern formation of the above-mentioned transparence electric conduction film 34 were heat-treated for 1 hour, and the electrode substrate 35 was obtained.

[0102] The reflexibility oxide system thin film layer 36 of the electrode substrate 35 obtained as mentioned above had 30 - 40% of reflection factor of the light, and was that which is effective as an electrode substrate for displays of a reflective mold. Incidentally, the reflection factor of the glass substrate side which does not form the reflexibility oxide system thin film layer 36 (cerium oxide) was about 5 - 6%.

[0103] In addition, although not illustrated, if the electrode substrate 35 obtained by this example 3 is the electrode substrate 35 for color picture displays, between a substrate 30 and the transparence electric conduction film 34 or on the transparence electric conduction film 34, it will carry out pattern formation of the color filter layer of the shape of a matrix colored red, green, and blue for every display pixel, and will form the electric conduction film 34 of the shape of a pattern corresponding to the pixel of the shape of the matrix.

[0104]

[Effect of the Invention] The electrode substrate for displays of this invention cannot be easily influenced of the oxygen at the time of membrane formation by using for a silver system thin film layer the silver alloy which added a small amount of gold and copper to silver, and can obtain the high electrode substrate of the transparency mold of light transmittance which a down does not produce in the permeability by the side of short wavelength, or the electrode substrate of the reflective mold of the high rate of a light reflex which a down does not produce in the reflection factor by the side of short wavelength.

[0105] Moreover, there is effectiveness whose moisture resistance as an electrode substrate may also improve to practical use level by little addition of gold and copper.

[0106] In case a transparence oxide thin film, a silver system thin film, and a transparence oxide thin film are especially produced with the in-line ones and INTABAKKU type membrane formation equipment which forms membranes continuously, since it is hard to be influenced of the oxygen at the time of membrane formation, much more remarkable effectiveness is acquired.

[0107] Possible [connection (mounting of TAB etc.) electric possible / the easy pattern formation by etchant, such as an acid,], since a mixed oxide made from cerium oxide and indium oxide is further used as a transparence oxide thin film, this invention can offer the transparent electrode of a low sheet resistivity value with high transmission, in addition the addition to the indium oxide of cerium oxide has effectiveness also in damp-proof improvement.

[0108] Moreover, since the electrode substrate for displays of this invention is equipped with the electric conduction film of a three-tiered structure thru/or 4 layer structures as pattern electric conduction film of an electrode, it can offer the transparent electrode which demonstrates the sheet resistivity value of low resistance (0.3ohms or less), and has high permeability or a high reflection factor, or a reflector.

[0109] The electrode substrate for displays of this invention with a high property moreover, besides the field of a display device For example, while the place which can apply also to the field of a solar battery, in addition also has heat ray reflection and the functionality of electromagnetic wave shielding etc., and contributes to the industrial world is size, being a low sheet resistivity value in a thin film and showing good conductivity There is effectiveness as an electrode substrate of the transparency mold which visible-ray permeability or whose reflection factor is high, moreover does not have degradation with the passage of time, and was excellent in preservation stability, or a reflective mold.

[Brief Description of the Drawings]

[Drawing 1] The sectional side elevation of the electrode substrate for displays in which the example of this invention is shown.

[Drawing 2] The sectional side elevation of the electrode substrate for displays in which other examples of this invention are shown.

[Drawing 3] The sectional side elevation of the electrode substrate for displays in which the example of others of this invention is shown.
[Drawing 4] The graph which shows the spectral transmittance of the electrode substrate for displays of the transparency mold of this invention.
[Drawing 5] The graph which shows the spectral reflectance A of the electrode substrate for displays of the reflective mold of this invention, and the spectral reflectance B of the electrode substrate for displays of the conventional reflective mold.
[Drawing 6] The graph which shows the effectiveness of raising depression of the permeability by the side of the short wavelength by the increment in an addition to the silver system thin film of the copper in the electrode substrate for displays of the transparency mold of this invention.
[Drawing 7] The graph which shows change and the spectral transmittance of addition [of the gold in the silver system electric conduction thin film in the electric conduction film of a configuration of pinching the silver system electric conduction thin film in the transparent electrode of this invention with a metallic oxide] ** - **.
[Drawing 8] The simulation graph which shows change and the spectral transmittance of addition [of the gold in the silver system electric conduction thin film in the electric conduction film of a configuration of pinching the silver system electric conduction thin film in the transparent electrode of this invention with a metallic oxide] ** - **.
[Drawing 9] The simulation graph which shows the change and the spectral transmittance (spectral reflectance) of thickness [of a silver system electric conduction thin film] ** - ** in the electric conduction film of a configuration of pinching the silver system electric conduction thin film in the transparent electrode of this invention with a metallic oxide.
[Drawing 10] The graph which shows 50nm - 200nm [of silver system thin films] the spectral reflectance and spectral transmittance in a reflector of this invention.
[Drawing 11] The sectional side elevation showing the conventional electrode substrate for displays.
[Description of Notations]
10 -- Substrate 11 -- Oxide system transparence electric conduction thin film layer 12 -- Silver system transparence electric conduction thin film layer
13 -- Oxide system transparence electric conduction thin film layer 14 -- Transparence electric conduction film 15 -- Transparency mold display electrode substrate
20 -- Substrate 21 -- Oxide system transparence electric conduction thin film layer 22 -- Silver system transparence electric conduction thin film layer
23 -- Oxide system transparence electric conduction thin film layer 24 -- Transparence electric conduction film 25 -- Transparency mold display electrode substrate
26 -- Optical diffusion layer
30 -- Substrate 31 -- Oxide system electric conduction thin film layer 32 -- Silver system electric conduction thin film layer
33 -- Oxide system transparence electric conduction thin film layer 34 -- Reflective electric conduction film 35 -- Reflective mold display electrode substrate
36 -- Reflexibility oxide system thin film layer
40 -- Substrate 41 -- Color filter layer 42 -- Light-shielding film 43 -- Transparent protection layer
44 -- Transparent electrode 45 -- Orientation film

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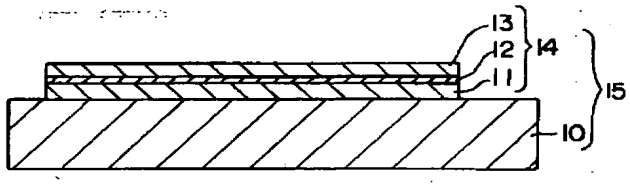
最終頁に続く

(54)【発明の名称】表示装置用電極基板

(57)【要約】
【課題】スパッタリングの成膜時のガス雰囲気の影響を受け難く安定した成膜を可能とするとともに、薄膜で導電性と可視光線透過率又は反射率が高く、しかも経時劣化がなく保存安定性に優れた透過型又は反射型の表示装置用電極基板を提供することにある。
【解決手段】基板１０上に銀系導電薄膜層１２を備え該銀系導電薄膜層１２の表裏面を酸化物系透明明導電薄膜層１１，１３にて挟持した構成の導電膜１４を備えた表示装置用電極基板１５において、上記酸化物系透明導電薄膜層の少なくとも一方が、酸化セリウムと酸化インジウムを材料とする透明な混合酸化物による薄膜層であり、且つ前記銀系導電薄膜層が０．１～２．５ａｔ％（atomic weight ％）の金と０．３～３．０ａｔ％の銅を含有する銀合金による薄膜層である。



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【特許請求の範囲】

【請求項１】基板上に、銀系導電薄膜層を備え該銀系導電薄膜層の表裏面を酸化物系透明導電薄膜層にて挟持した構成の導電膜を備えた表示装置用電極基板において、上記酸化物系透明導電薄膜層の少なくとも一方が、酸化セリウムと酸化インジウムを材料とする透明な混合酸化物による薄膜層であり、且つ前記銀系導電薄膜層が、０．１～２．５ａｔ％の金と、０．３～３．０ａｔ％の銅を含有する銀合金による薄膜層であることを特徴とする表示装置用電極基板。

【請求項２】前記銀系導電薄膜層の層厚が５～２５ｎｍの範囲内にある請求項１記載の表示装置用電極基板。

【請求項３】前記銀系導電薄膜層の層厚が５０～２００ｎｍの範囲内にある請求項１記載の表示装置用電極基板。

【請求項４】前記基板と導電膜との間にカラーフィルタが配設されている請求項１又は請求項２記載の表示装置用電極基板。

【請求項５】前記基板と導電膜との間に光散乱膜が配設されている請求項１又は請求項２又は請求項４記載の表示装置用電極基板。

【請求項６】前記基板と銀系導電薄膜層との間に位置する前記酸化物系透明導電薄膜層が屈折率２．１より大きい高屈折率の反射性薄膜層である請求項１又は請求項３記載の表示装置用電極基板。

【請求項７】前記基板と導電膜との間に屈折率２．１より大きい高屈折率絶縁膜を兼ねる反射性酸化物系薄膜層を備える請求項１又は請求項３記載の表示装置用電極基板。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、液晶ディスプレイ装置やプラズマディスプレイ装置などの出力表示装置あるいは表示画面から直接入力する入出力用表示装置あるいは太陽電池などに使用される透過型電極（透明電極）や反射型電極の電極基板に関し、特に薄膜で導電性と光線透過率が高く、しかも保存安定性に優れた電極基板に関する。

【０００２】

【従来の技術】ガラス、プラスチックフィルムなどの基板上に、可視光線を透過する電極形状の透明導電膜が設けられた電極板は、液晶ディスプレイ装置などの各種表示装置（表示画面）の表示用電極や、この表示装置の表示画面から直接入力できる入出力電極などに広く使用されている。

【０００３】例えば、液晶が用いられたディスプレイ装置の透明電極板は、図１１に示すように、ガラス基板４０と、このガラス基板４０上の画素部位に設けられ、画素毎にその透過光を赤、緑、青にそれぞれ着色するカラーフィルタ層４１と、上記ガラス基板４０上の画素と画素との間（画素間）の部位に設けられ、この部位からの光透過を防止する遮光膜４２と、上記カラーフィルタ層４１上の全面に設けられた透明保護層４３と、この保護層４３上にスパッタリングにより成膜され、所定の電極パターンにエッチングされたパターン状若しくはベタ状の透明電極４４と、この透明電極４４上に成膜された配向膜４５とでその主要部が構成されている。

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【０００４】この透明電極４４としては、その高い導電性に着目して、酸化インジウム中に酸化錫を添加したＩＴＯ薄膜が広く利用されており、その比抵抗はおよそ２．４×１０$^{-4}$Ω・ｃｍで、透明電極として通常適用される２４０ｎｍの膜厚の場合、その面積抵抗値はおよそ１０Ω（又は１０Ω／□、□；スクエアと称する）である。

【０００５】また、この他にも、酸化錫薄膜や、酸化錫に酸化アンチモンを添加して構成される薄膜（ネサ膜）、あるいは酸化亜鉛に酸化アルミニウムを添加して構成される薄膜などが知られているが、これらはいずれも上記ＩＴＯ薄膜よりも導電性が劣り、また酸やアルカリに対する耐薬品性あるいは耐水性などが不十分なために液晶向けの透明電極基板として一般には普及していない。

【０００６】一方、太陽電池用の透明電極基板においては、その製造プロセスの関係で、水素プラズマ耐性を必要とする。そのため、水素プラズマ耐性の高い酸化亜鉛を材料とする透明電極を用いることが一般的である。

【０００７】しかし、酸化亜鉛系の透明電極は、フッ素ドープしたものや、アルミナ添加したものでも抵抗値が高く、太陽電池用の透明電極基板として４００ｎｍ～８００ｎｍとかなり厚い膜厚にて形成する必要があった。

【０００８】一方、１９８２年、日本で開催された第７回ＩＣＶＭにおいて、熱線反射膜として銀薄膜の表裏面にＩＴＯ薄膜又は酸化インジウム薄膜（ＩＯ薄膜）を積層させて構成される３層構造の透明導電膜が提案されている。

【０００９】この３層構造の透明導電膜はおよそ５Ω程度の低い面積抵抗値を有しており、その高い導電性を生かして上記透明電極への応用が期待された。

【００１０】

【発明が解決しようとする課題】ところで、上記ディスプレイ装置や入出力装置においては、近年、画素密度を増大させて緻密な画面を表示することが求められ、これに伴って上記透明電極パターンの緻密化が要求されており、例えば１００μｍ程度のピッチで上記透明電極の端子部を構成することが要求されている。

【００１１】また、液晶ディスプレイ装置において基板に液晶駆動用ＩＣが直接接続される方式（ＣＯＧ）においては、配線の引き回しが、幅２０～５０μｍという細線となる部分があり、従来にない高度のエッチング加工適性と高い導電性（低い抵抗値）が要求されている。

【００１２】また、その一方で表示画面の大型化も求められており、このような大型画面化について、上述したような緻密パターンの透明電極を形成し、しかも液晶に十分な駆動電圧を印加できるようにするためには、上記透明電極として面積抵抗値５Ω以下という高い導電性を備えた透明電極を適用する必要があった。

【００１３】また、これに加えて、ＳＴＮ液晶等を利用した単純マトリクス駆動方式の液晶表示装置において、１６階調以上の多階調表示を行う場合には、３Ω以下というさらに低い面積抵抗値が要求されている。

【００１４】しかしながら、第７回ＩＣＶＭにおいて提案された上記３層構造の透明電極においても、高々５Ω程度の面積抵抗値が得られるに過ぎず、十分な導電性が確保できないという問題点があり、例えば、銀薄膜の厚さを１６～１８ｎｍ程度に厚くすることにより、その面積抵抗値を約３Ωに低下させることは可能であっても、可視光線透過率（特に波長６１０ｎｍ程度の長波長側の可視光線透過率）が７５％程度まで低下し、透明電極としての機能が損なわれてしまう。

【００１５】さらに、上記３層構造の透明電極においては、銀の薄膜が積層界面などから進入した空気中の水分と反応し易く、その表面に反応物を生成してシミ状の欠陥を生じ、例えば液晶表示装置の透明電極に適用した場合には、その表面に表示欠陥などを生じ易いという問題点があった。

【００１６】本発明者らは、３層構造の導電膜の耐湿性向上に、銀に金を添加した銀合金による銀系導電薄膜とすることにより、大幅な耐湿性向上の効果があることを見い出し、この構成を既に提案しており、金の添加量は４ａｔ％（ａｔｏｍｉｃ ｗｅｉｇｈｔ％、原子量パーセントを以下ａｔ％と称する）以下、例えば０．１～３．０ａｔ％の範囲で十分な効果のあることを見い出している。なお、３層構造の導電膜は、銀系導電薄膜層の膜厚を５ｎｍ～２５ｎｍの範囲内で可視光を透過する透明電極として、また実用上は膜厚をおよそ１５０ｎｍとして可視光を反射する反射電極として用いることができる。

【００１７】しかし、銀金合金の銀系導電薄膜を用いた３層構造の導電膜は、スパッタリングの成膜時のガス雰囲気の影響を受け易い欠点があった。特に、雰囲気中の酸素の影響を受け、透明電極としては可視域の短波長側の透過率が低下し易く、反射電極としては短波長側の反射率が低下し易い欠点があった。

【００１８】図７は、膜厚約１５ｎｍの銀系導電薄膜を金属酸化物で挟持する構成の導電膜（透明電極）の分光特性（分光透過率）を示すものである。なお、該導電膜の合計膜厚は９００Å、面積抵抗値は約３Ωである。なお、グラフ①は銀１００ａｔ％、金０ａｔ％、②は銀９９．９ａｔ％、金０．１ａｔ％、③は銀９９．８ａｔ％、金０．２ａｔ％、④は銀９９．６ａｔ％、金０．４

ａｔ％を示す。

【００１９】図７の一番上の破線で示す分光特性は、金を含まない銀薄膜による導電膜のもの、その他は０．１～０．５ａｔ％の金を含む銀系薄膜の導電膜の分光特性であり、光波長４７０ｎｍ付近の透過率のダウンが生じることが示されている。

【００２０】同じく図８には、金を０．８～２．５ａｔ％含む３層構造の導電膜の分光特性を示した。これも同様に４７０ｎｍ近辺の透過率がダウンしている。なお、該導電膜の合計膜厚は９００Å、面積抵抗値は約３Ωである。また、グラフ⑤は銀９９．１９ａｔ％、金０．８１ａｔ％、⑥は銀９８．４８ａｔ％、金１．５２ａｔ％、⑦は銀９７．５６ａｔ％、金２．４４ａｔ％を示す。

【００２１】この短波長側での透過率のダウンは、バッチ式の成膜装置による銀系薄膜の成膜前に、十分な排気を行うことによって酸素の影響を少なくすることによって、そのダウンの量を少なくすることができる。

【００２２】しかし、インライン型の量産タイプの成膜装置では、３層構造の導電膜における１層目と３層目の金属酸化物を成膜する際に酸素を導入するため、酸素の影響を受け易い。

【００２３】なお、この短波長側での透過率のダウンは、本発明者らが３層構造の導電膜の光学定数を調べた範囲では、銀系薄膜の短波長側の屈折率が上昇する現象を伴っている傾向を見い出しており、結果的には３層構造の導電膜の短波長側での光吸収が出ているようであるが、その詳細は未だよくわかっていない。

【００２４】本発明は、このような問題点に着目してなされたものであって、その課題とするところは、スパッタリングの成膜時のガス雰囲気の影響を受け難く安定した成膜を可能とするとともに、薄膜で導電性と可視光線透過率又は反射率が高く、しかも経時劣化がなく保存安定性に優れた透過型又は反射型の表示装置用電極基板を提供することにある。

【００２５】

【課題を解決するための手段】本発明の請求項１に係る発明は、基板上に銀系導電薄膜層を備え該銀系導電薄膜層の表裏面を酸化物系透明導電薄膜層にて挟持した構成の導電膜を備えた表示装置用電極基板において、上記酸化物系透明導電薄膜層の少なくとも一方が、酸化セリウムと酸化インジウムを材料とする透明な混合酸化物による薄膜層であり、且つ前記銀系導電薄膜層が、０．１～２．５ａｔ％の金と、０．３～３．０ａｔ％の銅を含有する銀合金による薄膜層であることを特徴とする表示装置用電極基板である。

【００２６】また本発明の請求項２に係る発明は、前記請求項１に記載する発明において、前記銀系導電薄膜層の層厚が、５～２５ｎｍの範囲内にある表示装置用電極基板である。

【００２７】また本発明の請求項３に係る発明は、前記請求項１に記載する発明において、前記銀系導電薄膜層の層厚が５０～２００ｎｍの範囲内にある表示装置用電極基板である。

【００２８】また本発明の請求項４に係る発明は、前記請求項１又は請求項２に記載する発明において、前記基板と導電膜との間にカラーフィルタが配設されている表示装置用電極基板である。

【００２９】また本発明の請求項５に係る発明は、前記請求項１又は請求項２又は請求項４に記載する発明において、前記基板と導電膜との間に光散乱膜が配設されている表示装置用電極基板である。

【００３０】また本発明の請求項６に係る発明は、前記請求項１又は請求項３に記載する発明において、前記基板と銀系導電薄膜層との間に位置する前記酸化物系透明導電薄膜層が屈折率２．１より大きい高屈折率の反射性薄膜層である表示装置用電極基板である。

【００３１】また本発明の請求項７に係る発明は、前記請求項１又は請求項３に記載する発明において、前記基板と導電膜との間に屈折率２．１より大きい高屈折率の絶縁膜を兼ねる反射性酸化物系薄膜層を備える表示装置用電極基板である。

【００３２】

【発明の実施の形態】本発明の請求項１に係る発明を、実施の形態にしたがって以下に詳細に説明する。

【００３３】本発明の請求項１に係る発明は、基板上に銀系導電薄膜層を備え該銀系導電薄膜層の表裏面を酸化物系透明明導電薄膜層にて挟持した構成の導電膜を備えた表示装置用電極基板において、上記酸化物系透明導電薄膜層の少なくとも一方が、酸化セリウムと酸化インジウムを材料とする透明な混合酸化物による薄膜層であり、且つ前記銀系導電薄膜層が、０．１～２．５ａｔ％の金と、０．３～３．０ａｔ％の銅を含有する銀合金による薄膜層である表示装置用電極基板である。

【００３４】この発明は、上記課題を解決するための手段として、銀と金の合金に、さらに銅を添加した銀金銅合金を用いて銀系薄膜を成膜することによって、銀系薄膜成膜時に、スパッタリング成膜の雰囲気による影響を少なくすることができることを見い出した。

【００３５】この場合、金、銅、いずれも添加量は３ａｔ％以下の少量でよく、少量の銅の添加によって、金を含有する銀系薄膜を用いた３層構造の導電膜の短波長側での透過率あるいは反射率のダウンなど悪い影響を無くすことができる。

【００３６】さらに、本発明者らは、３層構造の導電膜を透過型の表示装置用電極基板（透明電極）の用途として用いる場合に、高屈折率である酸化セリウムを酸化インジウムと混合した混合酸化物を、透明酸化物薄膜として用いることにより、透過率を向上でき、且つ耐湿性を改良できることを見い出した。

【００３７】混合酸化物には、必要に応じて酸化チタン、酸化ジルコニウム、酸化ハフニウム、酸化タンタル、二酸化珪素、酸化ガリウム、酸化錫、酸化ビスマス、その他の金属酸化物を少量添加してもよい。

【００３８】上記基板上における上記銀系導電薄膜層への金の添加量は、３層構造の導電膜である導電性接着層、銀系導電薄膜層、酸化物系透明導電薄膜層のそれぞれ耐湿性の向上に関しては、０．１ａｔ％の少量添加から効力があり、この添加量を多くするに従って耐湿性が向上する傾向がある。

【００３９】銅の銀系薄膜への添加量は、図６のグラフに示すように０．３ａｔ％程度から徐々に短波長側の落ち込みを上昇させる効果がある。なお、このグラフは、３層構造の導電膜であり、導電膜の総膜厚は約８５０Å（８５ｎｍ）である。

【００４０】銅は、銀に対して共晶の形をとるため（完全固溶でない）、銅の添加量が多くなると透過率若しくは反射率に悪い影響を与えるようになる。また添加量が多くなると導電膜の抵抗値が上昇する傾向があり、銀系薄膜の膜厚を１０ｍｍとし、且つ銅の添加量を３ａｔ％以上とした場合に面積抵抗値は５Ω（又は５Ω／□、□；スクエアと称する）を超えるようになる。

【００４１】次に、本発明の請求項２に係る発明を、実施の形態にしたがって以下に詳細に説明する。

【００４２】本発明の請求項２に係る発明は、前記請求項１に記載する発明において、前記銀系導電薄膜層の層厚が、５～２５ｎｍの範囲内にある表示装置用電極基板である。

【００４３】近時、ＳＴＮやＥＣＢなど単純マトリクス方式での液晶ディスプレイ装置の技術進展は著しく、ＣＲＴ代替のモニターとしてカラーＳＴＮを使おうという動きがある。

【００４４】据え置きのモニターの場合、１００Ｖ、１１０Ｖといった外部電源との接続が可能であり、こうしたことから、高輝度のバックライトの常用が可能となる。

【００４５】この観点から、モニター用途の単純マトリクスの液晶ディスプレイでは、これに用いる透明電極は、低抵抗であることを優先して光透過率をある程度犠牲にしてよいことになる。

【００４６】単純マトリクス方式では透明電極の面積抵抗値が２Ω付近になると、シャドウイングと称される画質の低下がほとんどなくなるため、実用レベルでＴＦＴと競合できる。

【００４７】図９に、透過型表示装置用電極基板（透明電極）の用途を前提として、ガラス基板上に、透明酸化物（屈折率２．２）３５ｎｍと、銀系薄膜１５ｎｍ～２５ｎｍと、透明酸化物４０ｎｍとを順次積層した透明な導電膜のシュミレーションによる分光特性データを示した。なお、媒質はエアー（気体；屈折率１．５）とし

た。なお銀系薄膜の膜厚が、①は膜厚１５ｎｍ、②は膜厚１７．５ｎｍ、③は膜厚２０ｎｍ、④は膜厚２２．５ｎｍ、⑤は膜厚２５ｎｍの場合を示す。

【００４８】銀系薄膜の膜厚が、２５ｎｍと厚い領域でもピークの透過率は８０％と、比較的良好である。また、銀系薄膜の膜厚２０ｎｍ強で、３層構造の導電膜の面積抵抗値は、約２Ωとなる。

【００４９】銀系薄膜は膜厚５ｎｍ未満ではアイランド状（ランド状）になり、均質な薄膜とならず、計算上の光学特性や面積抵抗値が得難くなる。

【００５０】次に、本発明の請求項３に係る発明を、実施の形態にしたがって以下に詳細に説明する。

【００５１】本発明の請求項３に係る発明は、前記請求項１に記載する発明において、前記銀系導電薄膜層の層厚が５０～２００ｎｍの範囲内にある表示装置用電極基板である。

【００５２】図１０に、反射型の表示装置用電極基板（反射電極）の用途を前提として、ガラス基板上に、透明酸化物１０ｎｍと、銀系薄膜５０ｎｍ～２００ｎｍと、透明酸化物（屈折率２．３）４０ｎｍを順次積層した導電膜の反射率のシミュレーション結果を示した。なお、媒質はエアー（気体；屈折率１）とした。また、このシミュレーションは、透明酸化物の光波長による屈折率や光消衰（光吸収）係数の変化（波長分散）は考慮していない。

【００５３】図１０は、銀系薄膜の膜厚による反射率への影響を示すものであるが、銀系薄膜の膜厚が、５０ｎｍを超えると８０％前後の反射電極となり、２００ｎｍで反射率は飽和して、光透過率はほぼ０％となることが示される。

【００５４】次に、本発明の請求項４に係る発明を、実施の形態にしたがって以下に詳細に説明する。

【００５５】本発明の請求項４に係る発明は、前記請求項１又は請求項２に記載する発明において、前記基板と導電膜との間にカラーフィルタが配設されている表示装置用電極基板である。

【００５６】透過型又は反射型の表示装置用の電極基板（例えば液晶表示装置用の電極基板）における基板と透明電極である３層構造の導電膜との間に、表示画素に対応してそれぞれ赤、緑、青などに着色されたカラーフィルタを配設することにより、上記電極基板はカラー画像の表示が可能となる。

【００５７】次に、本発明の請求項５に係る発明を、実施の形態にしたがって以下に詳細に説明する。

【００５８】本発明の請求項５に係る発明は、前記請求項１又は請求項２又は請求項４に記載する発明において、前記基板と導電膜との間に光散乱膜が配設されている表示装置用電極基板である。

【００５９】反射型の表示装置用の電極基板（例えば液晶表示装置用の電極基板）として用いる場合、あるいは

透過型であっても視野角を拡げるために、基板と導電膜との間に、光の散乱膜（光の拡散効果を持たせるデフュージョン膜）を配設することにより、高い効果を得ることができる。

【００６０】上記散乱膜は、カラーフィルタ上に重ね合わせるからカラーフィルタとは別体の層構成であってもよいし、カラーフィルタと散乱膜とを兼ねる構成であってもよい。

【００６１】上記散乱膜は、塗布膜表面の凹凸（若しくは、屈折率の異なる塗布膜表面の凹凸）による光の散乱（拡散）を利用してもよいし、屈折率の異なる樹脂を混合、又は屈折率の異なる樹脂と透明顔料とを混合した樹脂の塗布膜を利用することができる。また、対象とする液晶表示装置が、偏光フィルムや位相差フィルムを用いる方式の場合には、前記透明顔料は、非晶質や等軸晶質などの光学的に等方な材料が望ましい。

【００６２】次に、本発明の請求項６、請求項７に係る発明を、実施の形態にしたがって以下に詳細に説明する。

【００６３】本発明の請求項６に係る発明は、前記請求項１又は請求項３に記載する発明において、前記基板と銀系導電薄膜層との間に位置する前記酸化物系透明導電薄膜層が、屈折率２．１より大きい高屈折率の薄膜層（反射性酸化物系透明導電薄膜層）である表示装置用電極基板である。

【００６４】また本発明の請求項７に係る発明は、前記請求項１又は請求項３に記載する発明において、前記基板と導電膜との間に屈折率２．１より大きい高屈折率の絶縁膜を兼ねる反射性酸化物系薄膜層を備える表示装置用電極基板である。

【００６５】ＳＴＮやＥＣＢなど単純マトリクスＬＣＤ（液晶ディスプレイ）の反射型の表示装置用電極基板として、本発明の３層構造の導電膜を用いる場合、ストライプ状など電極パターンを形成する必要がある。

【００６６】上記反射型のＬＣＤの場合、白表示（通常ノーマリーホワイト）のときの反射光量を増やすことが重要なポイントである。

【００６７】ところが、ストライプパターン状に反射電極を加工すると、反射電極パターン間は素ガラス面が露呈しまい、この部分からの反射光が減少してしまうことになる。

【００６８】本発明者らは、基板側に高屈折率の薄膜層を残存させることによって反射光の利得を増大させ、反射光をディスプレイ表示のための照明光として有効に活用できることを見い出した。

【００６９】即ち、上記請求項６に係る発明において、前記基板と銀系導電薄膜層との間に位置する前記酸化物系透明導電薄膜層として、屈折率２．１より大きい高屈折率の薄膜層を用いて表示装置用電極基板としたものである。

【００７０】前記基板上のパターン導電膜としては、この高屈折率の一方の酸化物系透明導電薄膜層より上層にある銀系薄膜と他方の酸化物系透明導電薄膜層とをパターンエッチングすることにより得る。

【００７１】そして、この残存する前記高屈折率の一方の酸化物系透明導電薄膜層は、パターン導電膜の部分においては、３層構造の導電薄膜層のうちの１層を受け持つ導電膜構成層として使用し、パターン導電膜の無い部分においては、絶縁膜として使用するとともに、反射率を向上させるための高反射膜として使用するものである。

【００７２】また一方、上記請求項７に係る発明において、前記基板と導電膜との間、即ち直接、基板面に屈折率２．１より大きい高屈折率の絶縁膜を兼ねる酸化物系透明導電薄膜層を成膜して表示装置用電極基板としたものである。

【００７３】そして、前記基板上のパターン導電膜としては、基板面に直接成膜されたこの高屈折率の酸化物系透明導電薄膜層より上層にある一方の酸化物系透明導電薄膜層と銀系薄膜と他方の酸化物系透明導電薄膜層とをパターンエッチングすることにより得る。

【００７４】そして、この残存する前記高屈折率の酸化物系透明導電薄膜層は、パターン導電膜の部分においては、４層構造の導電薄膜層のうちの１層を受け持つ導電膜構成層として使用し、パターン導電膜の無い部分においては、絶縁膜として使用するとともに、反射率を向上させるための高反射膜として使用するものである。

【００７５】こうした高屈折率の絶縁膜としては、酸化チタン、酸化ジルコニウム、酸化ハフニウム、酸化タンタル、酸化セリウムなどの酸化物がある。

【００７６】こうした酸化物の混合酸化物、あるいは耐薬品性の良好な他の酸化物、例えば酸化ガリウムなどを少量添加した混合酸化物なども、同様に絶縁膜として用いることができる。

【００７７】なお、本発明の表示装置用電極基板を、反射型のＬＣＤ用の反射電極基板として用いる場合、基板は透明、半透明、不透明のいずれでもよく、又は白黒、その他の色に着色された基板であってもよい。

【００７８】基板の材料は、ガラス、プラスチックフィルム、プラスチックシート、セラミック、金属板、あるいはアモルファスシリコン、ポリシリコン、ＭＩＭなどの半導体素子が形成された基板など、種々のものが使用できる。

【００７９】また、本発明における３層構造の導電膜は、面積抵抗が低抵抗値であるため、ＴＦＴやＭＩＭなどの素子の信号線や、バスラインなどに使用して、画素電極とを兼ねるようにすることもできる。

【００８０】

【実施例】以下に、本発明の具体的実施例を示す。

【００８１】＜実施例１＞図１に示すように、この実施例に係る電極基板１５は、厚さ０．７ｍｍのガラス基板１０上に、順次積層された厚さ３５ｎｍの透明酸化物薄膜による酸化物系透明導電薄膜層１１と、厚さ１４ｎｍの銀系薄膜による銀系透明導電薄膜層１２と、厚さ３８ｎｍの透明酸化物薄膜による酸化物系透明導電薄膜層１３とでその主要部が構成された透明導電膜１４を成膜した。なお、上記酸化物系透明導電薄膜層１１、１３は、そのいずれも酸化インジウムの薄膜に、酸化セリウムを酸素を除く金属元素換算で３２ａｔ％加えた混合酸化物とした。また、銀系透明導電薄膜層１２は、銀に金を１．０ａｔ％、銅を１．５ａｔ％それぞれ添加した銀合金である。

【００８２】そして、上記透明導電膜１４は、以下のようにして成膜した。まず、厚さ０．７ｍｍのガラス基板１０の表面を有機アルカリ系界面活性剤と水とで洗浄した後に、真空槽内に収容し、逆スパッタリングと称されるプラズマ処理を施して、さらに洗浄した。

【００８３】次に、該ガラス基板１０を真空槽中から取り出すことなく、このガラス基板１０を室温に維持した状態で、スパッタリング法により、厚さ３５ｎｍの透明混合酸化物薄膜による酸化物系透明導電薄膜層１１、厚さ１４ｎｍの銀系薄膜による銀系透明導電薄膜層１２、厚さ３８ｎｍの透明混合酸化物薄膜による酸化物系透明導電薄膜層１３を順次成膜した。

【００８４】次に上記酸化物系透明導電薄膜層１３上に電極形状のレジスト膜をパターン形成し、このレジスト膜から露出した部位を硝酸系エッチング液によりパターンエッチングして、上記３層構造の薄膜を互いに位置整合させた状態で電極形状にパターニングし、続いて、２２０℃、１時間のアニール処理（加熱熟成処理）を施して、上記透明導電膜１４を形成した。

【００８５】こうして得られた透明導電膜１４の面積抵抗値は、約３．３Ωであった。そして、その透明導電膜１４の可視光線透過率は、図４に実線にて示すように、短波長側での透過率ダウンは見られず良好な結果が得られた。

【００８６】上記パターン形成した透明導電膜１４を、６０℃、湿度９５％内に、５００時間保持した後に表面観察したが、何ら外観変化は生じていなかった。なお、この混合酸化物によるそれぞれ酸化物系透明導電薄膜層１１、１３の屈折率を測定したところ、２．２４であった。

【００８７】なお、図示しないが、本実施例１により得られた電極基板１５が、カラー画像表示装置用の電極基板１５であれば、基板１０と透明導電膜１４との間、又は透明導電膜１４上に、表示画素毎に赤、緑、青に着色したマトリクス状のカラーフィルタ層をパターン形成し、そのマトリクス状の画素に対応するパターン状の導電膜１４を形成するものである。

【００８８】＜実施例２＞図２に示すように、この実施

例に係る電極基板２５は、厚さ０．７ｍｍのガラス基板２０上に積層した光拡散層２６（視野角を拡げる光散乱膜）上に、順次、厚さ３５ｎｍの透明酸化物薄膜による酸化物系透明導電薄膜層２１と、厚さ１５ｎｍの銀系薄膜による銀系透明導電薄膜層２２と、厚さ３８ｎｍの透明酸化物薄膜による酸化物系透明導電薄膜層２３とでその主要部が構成された透明導電薄膜を成膜し、その後パターン形成して透明導電膜２４を形成した。なお、この透明導電膜２４は、上記実施例１と同様の材料及び製法を用いてパターン形成した。

【００８９】また、上記光拡散層２６は、アクリルエポキシ樹脂に光拡散剤として酸化セリウムの微粉体（パウダー）を分散混合させた塗膜であり、膜厚約１μｍに形成した。

【００９０】こうして得られた透明導電膜２４の面積抵抗値は、実施例１と同様に約３．３Ωであった。そして、その透明導電膜２４の可視光線透過率は、上記実施例１と同様に、短波長側での透過率ダウンは見られず良好な結果が得られた。

【００９１】そして、上記パターン形成した透明導電膜２４を、６０℃、湿度９５％内に、５００時間保持した後に表面観察したが、何ら外観変化は生じていなかった。

【００９２】なお、図示しないが、本実施例２により得られた電極基板２５が、カラー画像表示装置用の電極基板２５であれば、基板２０と透明導電膜２４との間、又は透明導電膜２４上に、表示画素毎に赤、緑、青に着色したマトリクス状のカラーフィルタ層をパターン形成し、そのマトリクス状の画素に対応するパターン状の導電膜２４を形成するものである。

【００９３】＜実施例３＞図３に示すように、この実施例に係る電極基板３５は、厚さ０．５ｍｍのガラス基板３０上に、絶縁膜と高反射膜とを兼ねる高屈折率（屈折率２．１以上）の酸化セリウムの透明酸化物薄膜による例えば厚さ３０ｎｍ以上、好ましくは厚さ５５ｎｍの反射性酸化物系薄膜層３６を積層した後、順次、厚さ１０ｎｍの透明混合酸化物薄膜による酸化物系透明導電薄膜層３１と、厚さ１５０ｎｍの銀系薄膜による銀系導電薄膜層３２（透明ではない）と、厚さ７５ｎｍの透明混合酸化物薄膜による酸化物系透明導電薄膜層３３とでその主要部が構成された導電薄膜３４（透明ではない）を成膜した。

【００９４】酸化物系透明導電薄膜層３１、３３は、上記実施例１と同様にして、酸化セリウムと酸化インジウムの混合酸化物により成膜した。

【００９５】上記１層の反射性酸化物系薄膜層３６と、上記３層の導電薄膜３４とによる４層構造の導電膜の面積抵抗値は約０．２Ωであった。

【００９６】そして、銀系薄膜の膜厚を１５０ｎｍとすることによって、図５のグラフＡに示すように３層の導

電薄膜３４の短波長側での反射率ダウンは生じることなく、良好な光反射性の電極基板となった。

【００９７】ところで、同図５のグラフＢに、銀に金を１ａｔ％添加した銀合金による銀系薄膜層を備えた従来の３層構造の導電膜（銀系薄膜の膜厚は１５０ｎｍ）の分光反射率のデータを示す。

【００９８】これによると、短波長側の反射率のダウン、及び４６０ｎｍ付近での分光反射率のダウンがあり、これは透明電極での光透過率の場合と同様に、成膜時の酸素のガス導入を増やすことにより顕著になると考えられる。

【００９９】ところが、本実施例３によれば、銀系薄膜の膜厚を１５０ｎｍと厚くしても、図５のグラフＡに示すように短波長側での反射率ダウンは発生せず改善が見られた。

【０１００】その後、酸化物系透明導電薄膜層３１、３３、及び銀系薄膜層３２をパターンエッチングして透明導電膜３４（パターン導電膜）を形成した。この透明導電膜３４は、上記実施例１と同様にして通常のフォトリソプロセスで行い、上記実施例１と同様の材料及び製法を用いてパターン形成した。なお、酸化セリウム単体による反射性酸化物系薄膜層３６は他より耐酸性があり、通常のエッチングではこれを残すことができ、パターン導電膜の無い部分に、反射性酸化物系薄膜層３６を残存露呈させることができた。

【０１０１】そして、上記透明導電膜３４をパターン形成した基板３０を、２２０℃、１時間、熱処理して電極基板３５を得た。

【０１０２】上記のようにして得られた電極基板３５の反射性酸化物系薄膜層３６は、可視光の３０～４０％の反射率をもっており、反射型の表示装置用電極基板として効果のあるものであった。因みに、反射性酸化物系薄膜層３６（酸化セリウム）を形成しないガラス基板面の反射率は５～６％程度であった。

【０１０３】なお、図示しないが、本実施例３により得られた電極基板３５が、カラー画像表示装置用の電極基板３５であれば、基板３０と透明導電膜３４との間、又は透明導電膜３４上に、表示画素毎に赤、緑、青に着色したマトリクス状のカラーフィルタ層をパターン形成し、そのマトリクス状の画素に対応するパターン状の導電膜３４を形成するものである。

【０１０４】

【発明の効果】本発明の表示装置用電極基板は、銀に少量の金と銅とを添加した銀合金を銀系薄膜層に用いることにより、成膜時の酸素の影響を受け難く、短波長側の透過率にダウンの生じない高い光透過率の透過型の電極基板、あるいは短波長側の反射率にダウンの生じない高い光反射率の反射型の電極基板を得ることができる。

【０１０５】また、金と銅の少量添加により、電極基板としての耐湿性も実用レベルまで向上し得る効果があ

る。

【０１０６】特に、透明酸化物薄膜と、銀系薄膜と、透明酸化物薄膜とを、連続して成膜するインラインやインターバックタイプの成膜装置にて生産する際に、成膜時の酸素の影響を受け難いために一層顕著な効果が得られる。

【０１０７】本発明はさらに、酸化セリウムと酸化インジウムとを材料とする混合酸化物を透明酸化物薄膜として用いるため、酸などのエッチャントによる容易なパターン形成が可能であり、且つ電気的な接続（ＴＡＢなどの実装）も可能であり、また高い透過率で低い面積抵抗値の透明電極を提供でき、加えて、酸化セリウムの酸化インジウムへの添加は、耐湿性向上にも効果のあるものである。

【０１０８】また、本発明の表示装置用電極基板は、電極のパターン導電膜として３層構造乃至４層構造の導電膜を備えているため、低抵抗（０．３Ω以下）の面積抵抗値を発揮し、且つ高い透過率又は高い反射率をもつ透明電極、あるいは反射電極を提供できる。

【０１０９】また、本発明の表示装置用電極基板は、高い特性により、表示素子の分野以外にも、例えば太陽電池の分野にも応用が可能であり、その他に、熱線反射や、電磁波シールドなどの機能性をも併せもち、産業界に寄与するところが大であり、薄膜で低い面積抵抗値であって良好な導電性を示すとともに、可視光線透過率又は反射率が高く、しかも経時劣化がなく保存安定性に優れた透過型又は反射型の電極基板としての効果がある。

【図面の簡単な説明】

【図１】本発明の実施例を示す表示装置用電極基板の側断面図。

【図２】本発明の他の実施例を示す表示装置用電極基板の側断面図。

【図３】本発明のその他の実施例を示す表示装置用電極基板の側断面図。

【図４】本発明の透過型の表示装置用電極基板の分光透過率を示すグラフ。

【図５】本発明の反射型の表示装置用電極基板の分光反射率Ａと、従来の反射型の表示装置用電極基板の分光反射率Ｂとを示すグラフ。

【図６】本発明の透過型の表示装置用電極基板における銅の銀系薄膜への添加量増加による短波長側の透過率の落ち込みを上昇させる効果を示すグラフ。

【図７】本発明の透明電極における銀系導電薄膜を金属酸化物で挟持する構成の導電膜における銀系導電薄膜中の金の添加量①～④の変化と分光透過率を示すグラフ。

【図８】本発明の透明電極における銀系導電薄膜を金属酸化物で挟持する構成の導電膜における銀系導電薄膜中の金の添加量⑤～⑦の変化と分光透過率を示すシミュレーショングラフ。

【図９】本発明の透明電極における銀系導電薄膜を金属酸化物で挟持する構成の導電膜における銀系導電薄膜の膜厚①～⑤の変化と分光透過率（分光反射率）を示すシミュレーショングラフ。

【図１０】本発明の反射電極における銀系薄膜５０ｎｍ～２００ｎｍでの分光反射率と分光透過率を示すグラフ。

【図１１】従来の表示装置用電極基板を示す側断面図。

【符号の説明】

１０…基板　１１…酸化物系透明導電薄膜層　１２…銀系透明導電薄膜層

１３…酸化物系透明導電薄膜層　１４…透明導電膜　１５…透過型表示電極基板

２０…基板　２１…酸化物系透明導電薄膜層　２２…銀系透明導電薄膜層

２３…酸化物系透明導電薄膜層　２４…透明導電膜　２５…透過型表示電極基板

２６…光拡散層

３０…基板　３１…酸化物系導電薄膜層　３２…銀系導電薄膜層

３３…酸化物系透明導電薄膜層　３４…反射導電膜　３５…反射型表示電極基板

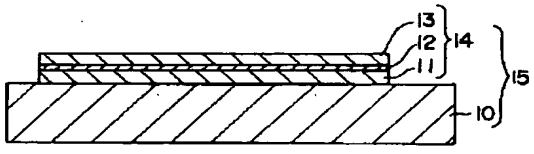
３６…反射性酸化物系薄膜層

４０…基板　４１…カラーフィルタ層　４２…遮光膜

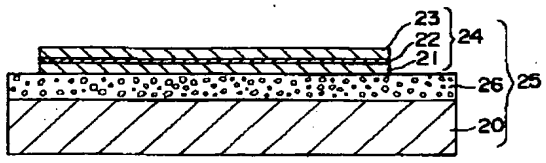
４３…透明保護層

４４…透明電極　４５…配向膜

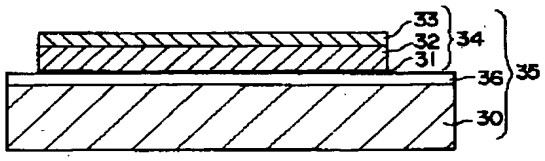
【図１】



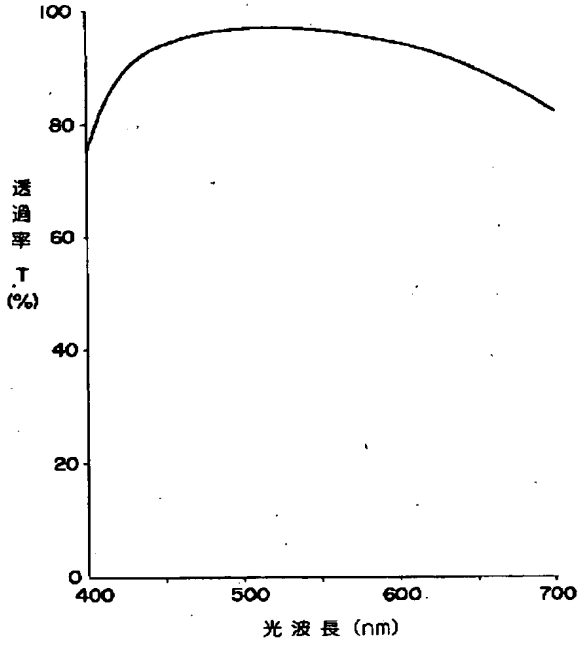
【図２】



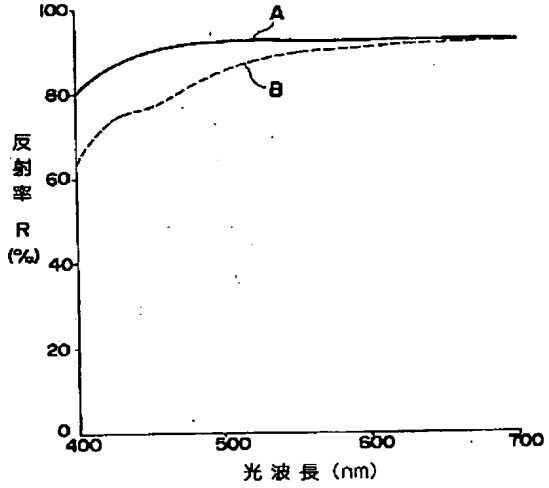
【図３】



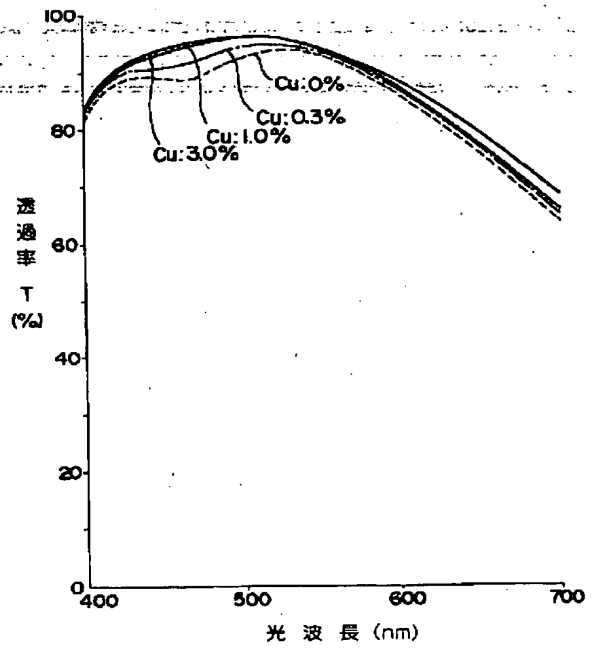
【図４】



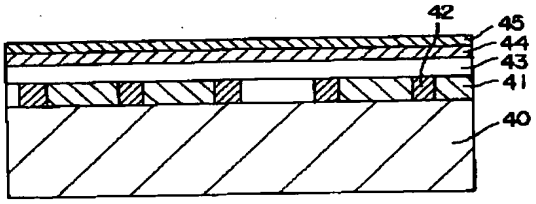
【図５】



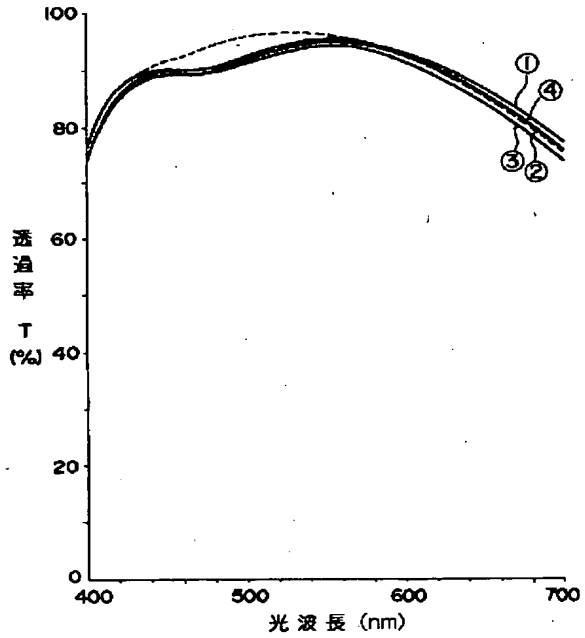
【図６】



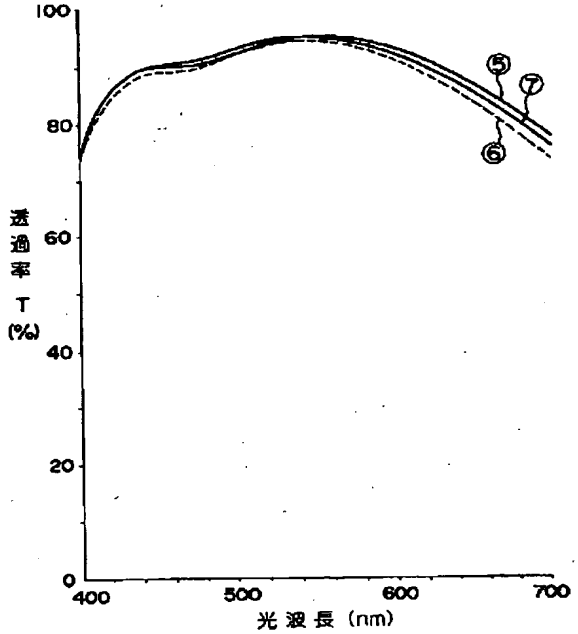
【図1-1】



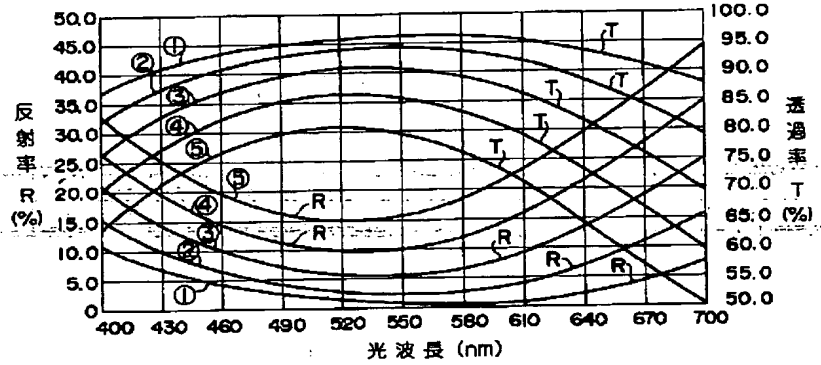
【図７】


100
80
60
40
20
0
透過率 T (%)
400
500
600
700
光波長 (nm)
①
④
③
②

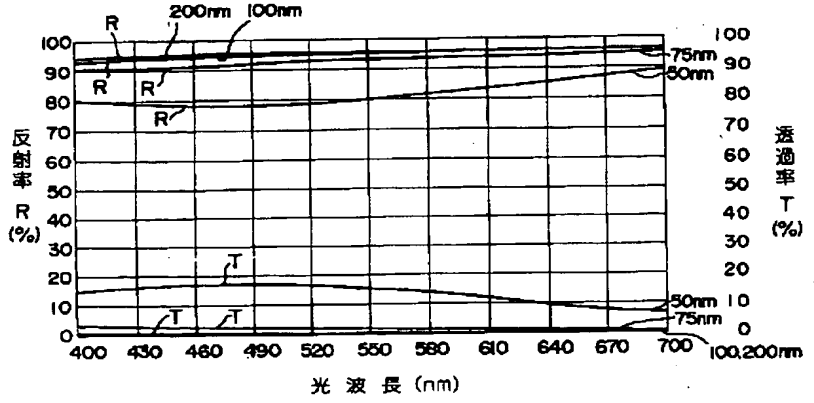
【図８】


100
80
60
40
20
0
透過率 T (%)
400
500
600
700
光波長 (nm)
⑤
⑦
⑥

【図９】


反射率 R (%)
透過率 T (%)
光波長 (nm)
400 430 460 490 520 550 580 610 640 670 700
R
T

【図１０】


反射率 R (%)
透過率 T (%)
光波長 (nm)
400 430 460 490 520 550 580 610 640 670 700
200nm
100nm
75nm
50nm
R
T

(11)[redacted]

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